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Restructuring Urban Outskirts Industrial Areas from the Industrial Clustering Perspective: A Case Study in Shunde, China

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Abstract: Large numbers of industrial zones have emerged in the urban outskirts of developing countries. Generally, these zones become economically efficient and environmentally unfriendly due to a lack of regulation and poor planning. Therefore, a restructuring of underperforming industrial areas is urgently needed. However, most restructuring processes lead to economic and social issues, such as deindustrialization and unemployment. Therefore, this study proposed a restructuring framework specific to the industrial areas in the urban outskirts and tested it in a case study in Shunde, China. In the framework, securing the existing industrial cluster is given sufficient attention, and the retained firms are relocated to dedicated resettlement sites before the demolition begins. As a result, the industrial clusters were successfully maintained after the restructuring. Moreover, the introduction of vertical factories allows for additional land supply and improves the environment to a great extent. Consequently, one world-class high-tech firm was added to the restructured areas. The restructuring framework and the case study should shed light on other restructuring projects occurring in developing countries.

Keywords: restructuring; urban outskirts; industrial cluster; vertical factories; industrial parks

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1. Introduction

1.1. Background

The ongoing global megatrends, such as digital transformation and increasing scarcity of resources, have encouraged developing countries to focus on developing the service sector [1–3]. Accordingly, manufacturing industries that generate significant carbon emissions [4], pollution [5], and congestion [6] are set aside and pushed to the urban outskirts, where urban infrastructure and consumers are still accessible and the rental cost is affordable [7]. Eventually, meso-scale industrial parks are formed [8,9]. Due to the geographical proximity, outskirts-factories also benefit from externalities such as knowledge and social capital spillovers [10]. As a result, many hidden champions had hatched in these areas in developing countries [11]. However, three issues having to do with a lack of planning arose along with the growth of these industrial areas. First, due to the lack of regulation, these factories generate tremendous pollution and carbon dioxide [4,5]. Secondly, because the local government generally neglects the governance of the urban outskirts, holistic planning is absent from coordinating the infrastructure construction and regional development [7,12]; as a result, land utilization is inefficient. Lastly, fragmented land uses are ubiquitous due to the co-ownerships of the land and properties and the limitation of the surrounding natural environments [13]. While urban planners have been trying to limit urban sprawl since the late 1990s across the world [14,15] and environmental sustainability is increasingly needed, there is a growing urgency for restructuring outskirt industrial areas. Therefore, this study

aims to review different ways of restructuring outskirt industrial areas, propose a novel restructuring framework, and test it in a case study in Shunde, China.

1.2. The Past Restructuring Efforts and Risks

Scholars addressed three main challenges for restructuring the outskirts of industrial areas: the co-ownerships of the land and properties [16,17], the long-existing negligence of different stakeholders' interests [17,18] and the fragmented land blocks (due to the surrounding natural environments). In terms of solving the issues caused by the co-ownerships and the unequal interest representation of stakeholders, Yuan et al. [18] proposed forming a benefit-sharing mechanism wherein stakeholders negotiate and settle their benefits during the restructuring process. In another study, Gomes et al. proposed a methodology that can engage stakeholders in the building and assessment of future land use scenarios [19]. With the accumulating restructuring experiences, scholars realized that the process requires a more holistic and systematic strategy to engage needs at different governance levels. For instance, Liang et al. proposed a restructuring concept in which industrial restructuring goals were systematically set at the village-, town-, and district levels, unifying the needs of different stakeholders. They further quantitatively estimated various industrial parks' efficiency and performance, allowing for full-cycle monitoring of the restructuring process [20,21]. New technologies could provide some solutions for solving issues caused by the fragmented land blocks. For example, 'vertical factories,' which emerged recently, allow for different functions such as offices and production lines to co-locate in the same building [22]. In the case study of this research, we visited a few vertical factories.

Restructuring the outskirts of industrial areas could lead to different social issues. Local governments were motivated to promote servicing economy by sacrificing the local manufacturing industry [2,3,23]. When manufacturing activities are suppressed, e.g., by re-zoning land uses or raising emissions standards, the factories have to relocate to other under-developed areas [24,25]. As a result, the local labor market faced tremendous shocks, leading to a series of social challenges, including unemployment and an enlarged skills gap [25,26]. Reviewing the restructuring effect in China is particularly relevant in this study, given that the second largest economy is undergoing economic transitions. Its restructuring experiences can offer insights for other developing countries. In China, two policies are used to guide the restructuring of the outskirt industrial areas. First, the *Tui Er Jin San* policy aims to suppress the manufacturing industry and develop the service industry. The second policy, "demolition first; attract investment later," seeks to demolish old and inefficient factories and then attract investment later [23]. Such a policy has also been used in restructuring the American Rust Belt [27]. However, both policies had not considered or given sufficient attention to the existing industrial clusters. In most of the restructuring processes, the stakeholders of the current industrial clusters, such as the factory owners and employees, are absent from participation in the process, while the local governments, developers, and landowners were in charge [23]. When the restructuring finishes, the rental cost increases and more local factories move out of the areas, further provoking investments in non-manufacturing industries. Such a vicious cycle damages the local industrial cluster, leading to deindustrialization. Therefore, to secure the local industrial cluster, scholars suggested a more equitable restructuring framework, where stakeholders such as factory owners, employees, landowners, local governments, and developers should contribute to the process with corresponding representations [23].

In summary, restructuring outskirt industrial areas face tremendous challenges, including co-ownerships, deindustrialization issues, and long-existing negligence of factory owners' interests. The proposed framework of this study tried to solve these challenges with the novelty of sustaining the existing industrial clusters.

1.3. The Resilience of the Industrial Cluster

Sustaining a prosperous industrial cluster before and after the restructuring could be a decisive factor in success. The idea of an industrial cluster refers to a geographic

concentration of interconnected industries which supply or consume the goods of others and benefit from low transaction costs, infrastructure sharing, and other externalities such as knowledge and social capital spillovers, forming agglomeration economies and superior competitive advantages [28]. Along with the anti-globalization movement [29] and the emerging concerns of supply chain security [30], empirical studies have been paying more attention to the resilience of industrial clusters. In the context of restructuring, the resilience of existing industrial clusters is of significance. Resilience has two main aspects, the capability to accommodate shocks and the ability to recover, renew, and reorient [31,32]. Scholars believe resilience is associated with a variety of industries. However, there have been vast debates about that. Variety comes in two distinct forms, the related variety within sectors and the unrelated variety between industries [33]. Related variety was believed to facilitate knowledge sharing and generate innovation and new technologies, which refers to "Jacobs' externalities" [34]. However, empirical studies show that regions of related variety could be vulnerable to industry-specific shocks [35,36]. Accordingly, unrelated variety, referring to a portfolio of industries, protects a region from external shocks [33]. To sustain the resilience of the existing industrial cluster, we believe key firms that contribute significantly to the resilience of the industrial cluster should be given sufficient attention so that the industrial cluster can sustain itself after restructuring.

There are accumulated experiences in identifying these key firms. Firstly, empirical studies show that large-sized firms exhibit strong resilience [37]. Abundant cash flows, technological monopolies, and sophisticated distribution networks underscore their strong positions [37]. Moreover, they also control the supply chains by investing in related firms [37]. Other studies also show that large firms have stronger financing positions and benefit from economies of scale, exhibiting long-term resilience [38]. Innovation capability is also associated with the resilience of the industrial cluster. An innovative industrial cluster exhibits strong leapfrogging capability, generating economic variety [39]. A region with a relatively complete supply chain also exhibits strong resilience. Li et al. found that large firms integrated the local supply chain during the financial crisis in 2008, allowing them to accommodate external shocks [40]. Hu et al. posited that the integration of the local supply chain allows a stronger control over the delivery of intermediate products [41]. Wu et al. addressed the importance of balanced capacities between the upstream and downstream supply chains. For example, if the upstream supply chain cannot fulfill the demands of the downstream supply chain, the overall efficiency would decrease [42]. The geographical distribution of the supply chain also matters. If the production process involved overseas suppliers, the risks of an interruptive supply chain increased to a great extent [42]. Conclusively, suppose a firm controls a large portion of the supply chain (e.g., via investing in other firms) and is geographically close to other firms; in that case, it is the industrial cluster's key firm that deserves attention during the restructuring process.

The restructuring process also involves attracting new industries and new firms, as there are urgent needs to fill in the vacancy of the buildings and land. Even though such a process is generally beyond the control of the government, incentive policies such as tax abatement, free or low-cost land, and training support were deployed to motivate certain kinds of firms or industries to move in [43].

In summary, securing a resilient industrial cluster is of significant importance to the success of the restructuring process. This study identified the key firms by using three important factors relevant to the resilience of industrial clusters: the firm size, innovation capability, and the role it plays in the supply chain. The research framework of this study is illustrated in Figure 1. First, in the Materials and Methods section, we will propose a restructuring framework and address the methodology and the case study area. Then, in the Results section, we will address the findings of the restructuring project to-date. Finally, we will draw a conclusion and discuss the limitations of this study in the last section.

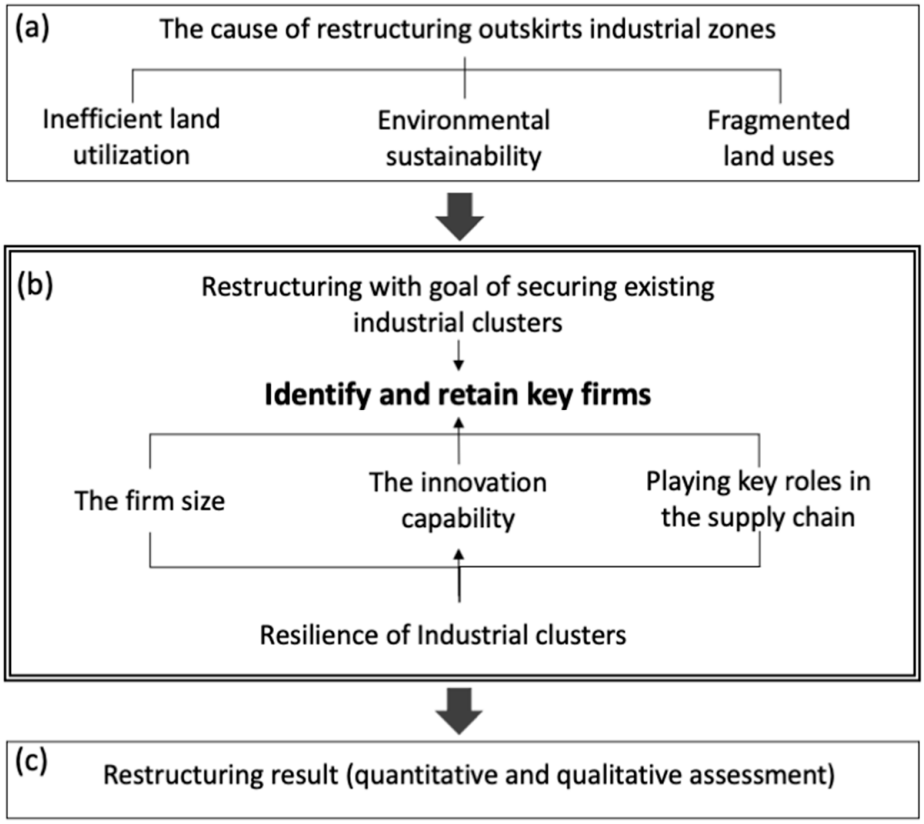

Figure 1. Research framework. Panel (**a**) addresses the reason why restructuring the outskirts industrial zones is important. Next, panel (**b**) addresses the three criteria for identifying key firms to retain the existing industrial clusters. Finally, we will present the restructuring result (panel (**c**)).

2. Materials and Methods

2.1. Restructuring Framework

Before building the restructuring framework, we underwent a series of consultations with key stakeholders, including the local authorities, landowners, and local firms. This consultation process allowed us to understand their demands and expectations, thereby facilitating the data-collection and restructuring process. The local authorities include the Municipal Economy Promotion Bureau and the Municipal Planning and Natural Resources Bureau. The former agency expected that the restructuring process could retain the local industrial clusters and attract elite firms to relocate in the region. The latter expected the restructuring process to strictly follow the land use regulation and improve the built environments in the region. Their expectations align well with the objectives of the restructuring process (see Figure 1a). The landowners have collectively commissioned the local village to manage the land on their behalf. In this regard, we consulted the village committee and accordingly the committee communicated the restructuring process with the landowners. The consultation reaches a consensus between landowners that the restructuring process would certainly induce a short-term rental loss to the landowners but achieve long-term benefits, including higher rental income and better built environments. Such a bottom-up process facilitates the restructuring process. The consultation with local firms is presented in Section 2.1.3.

This study proposed a restructuring framework (see Figure 2) that comprises four main steps.

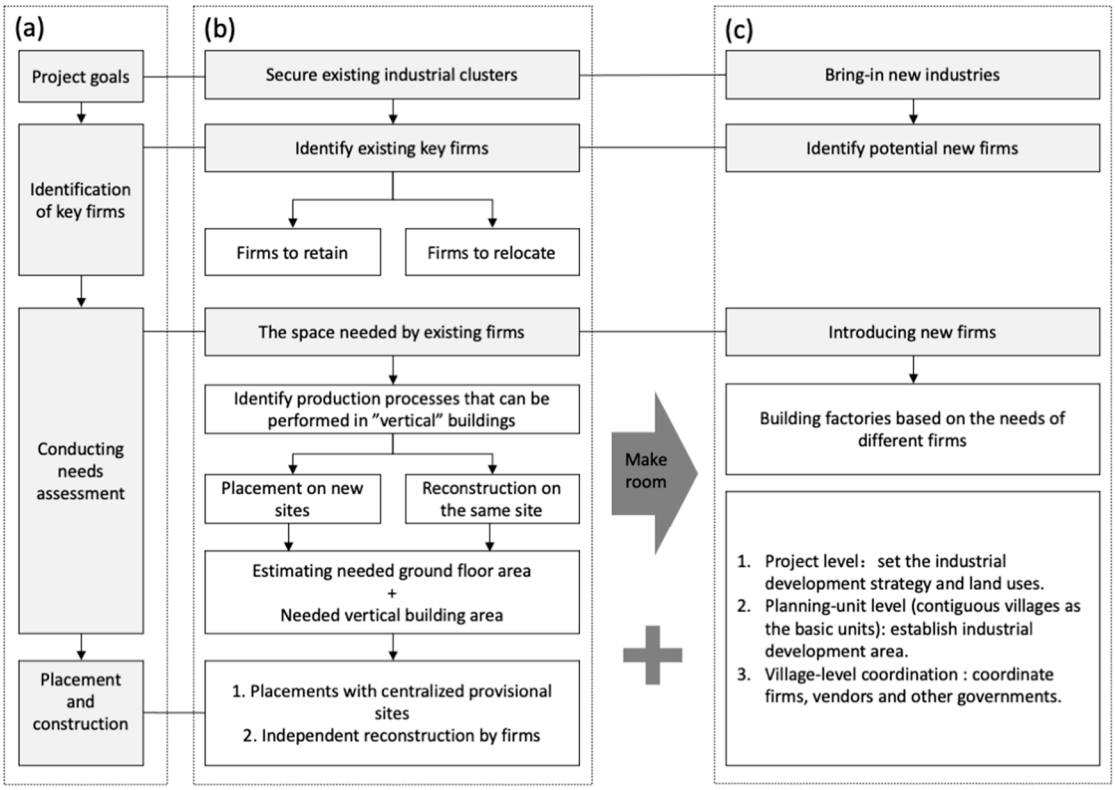

Figure 2. Restructuring framework. The framework guides the restructuring process and was applied in the case study. Panel (**a**) addresses the four main steps of the framework. Next, panel (**b**) addresses detailed approaches to securing the existing industrial cluster. Finally, panel (**c**) addresses how to bring in new industries.

2.1.1. Setting Up Goals for the Project

In this step, we set up the goals of the project. More specifically, we determined what kinds of industrial clusters need to be retained and which new industries need to be developed. This requires the foresight of emerging and shrinking industries. Furthermore, the global product space research provided useful materials [44] to inform the competitive advantage of the goods that the project area produces [45]. Therefore, we built a global product space and mapped the advantaged products in the space to study the existing industrial clusters and determine what new industries this area needs to develop.

2.1.2. Identification of Key Firms

This step aims to identify existing key firms (see Figures 1b and 2b) which are relevant to the existing industrial clusters, as well as new firms that would benefit the development of the new industries. Based on the three factors that are relevant to the resilience of an industrial cluster (i.e., the firm size, the innovation capability, and the roles the firm play in the supply chain), we classified the existing firms into three distinct types. Type-A firms include firms that own large numbers of employees and generate huge revenue. This type also includes firms in the high-tech sector and firms with many interconnections with other firms in the region. Type B consists of three kinds of firms: firms with relatively high revenue (measured the revenue per square meters), small-medium firms that have been growing fast, and lastly, firms that have applied for high-tech certificates. Type-C includes all the remaining firms. We also sampled firms from all three types and interviewed them to confirm that the criteria were met. A final list of firms classified into different types was submitted to the government. Ideally, Type-A and Type-B firms are to be retained.

2.1.3. Conducting a Needs Assessment

This step aims to understand the needs of the firms. That includes the demands of retained and new firms (e.g., the location and the floor area) and the firms that need to be displaced (e.g., the compensation). Moreover, we consulted the firms on whether or not the production process can be performed in a vertical factory. After iterative consultations with the firms and the local governments, we formulated a series of plans that guided different restructuring stages. More specifically, the plans include the industrial development strategy of the project area, the land uses, the resettlement sites for accommodating the retained firms, and the action plans that guide different stakeholders.

2.1.4. Placement and Construction

During the placement and construction stage, the retained firms would move to the allocated resettlement sites and the Type-C firms would leave the project area. Some firms designed their factories and built them on the allocated site, while others optimized their production process to adapt to the vertical factory setup. Meanwhile, village-level authorities coordinated with firms to facilitate the placement and construction process. The main advantage and also the major difference of this restructuring framework compared to other restructuring processes are that we would settle the firms and streamline the relocation before the construction started, reducing the loss of the firm owners to a great extent.

2.2. Study Area

We tested the industrial cluster-focused restructuring framework in a typical outskirt industrial area, Beijiao Town (hereafter called Beijiao). The town is located in Shunde City, Guangdong Province, China (see Figure 3 for Beijiao's geographic location). Since China's reform and opening, an influx of foreign investment has flourished in the Guangdong province of China, forming unique economic cooperation called the "front shop, back factory," where Hong Kong functions as a retail trade and brand development area and major sources of investment, while the Pearl River Delta is a labor-intensive production powerhouse [46]. Such a development was unique in another way. It thrived in the urban outskirts, where agricultural and manufacturing activities co-occurred in the same place. Such transitions, sometimes referred to as Desakota [47], have also appeared widely in Southeast Asia, including Indonesia, Thailand, Japan, and South Korea [48].

In 2018, the local government of Shunde prioritized the task of restructuring urban outskirt industrial areas. Since then, a few previous restructuring projects ignored the needs of the existing firms, demolishing factories without sufficient consultation and damaging the existing industrial cluster. As a result, a series of social issues emerged, such as unemployment. The Beijiao Town government (under the supervision of the Shunde government) realized such restructuring practices were unsustainable, and appointed us to propose a restructuring framework and monitor the restructuring process.

In Beijiao, 26 urban outskirts industrial parks are the leading geographical units for accommodating various kinds of firms. Beijiao is famous for its household appliances manufacturing industry and is also home to a few world-class manufacturing firms, including Midea Appliances. The 26 industrial parks cover a total of 1.57 square kilometers of land area and accommodate 2051 manufacturing firms. Moreover, these firms account for 56% of the gross domestic product (GDP) value of Beijiao's secondary industry and 64% of Beijiao's large manufacturing firms (with more than CNY 20 million revenue per year). There are dozens of firms whose annual revenue exceeds CNY 100 million and large numbers of hidden champions [11]. There are dominant industries, including metal additive manufacturing, plastic manufacturing, and machinery manufacturing industries. In addition, it includes other industries, such as furniture, special equipment, agricultural by-products, papermaking, packaging and printing, and non-metallic mineral products.

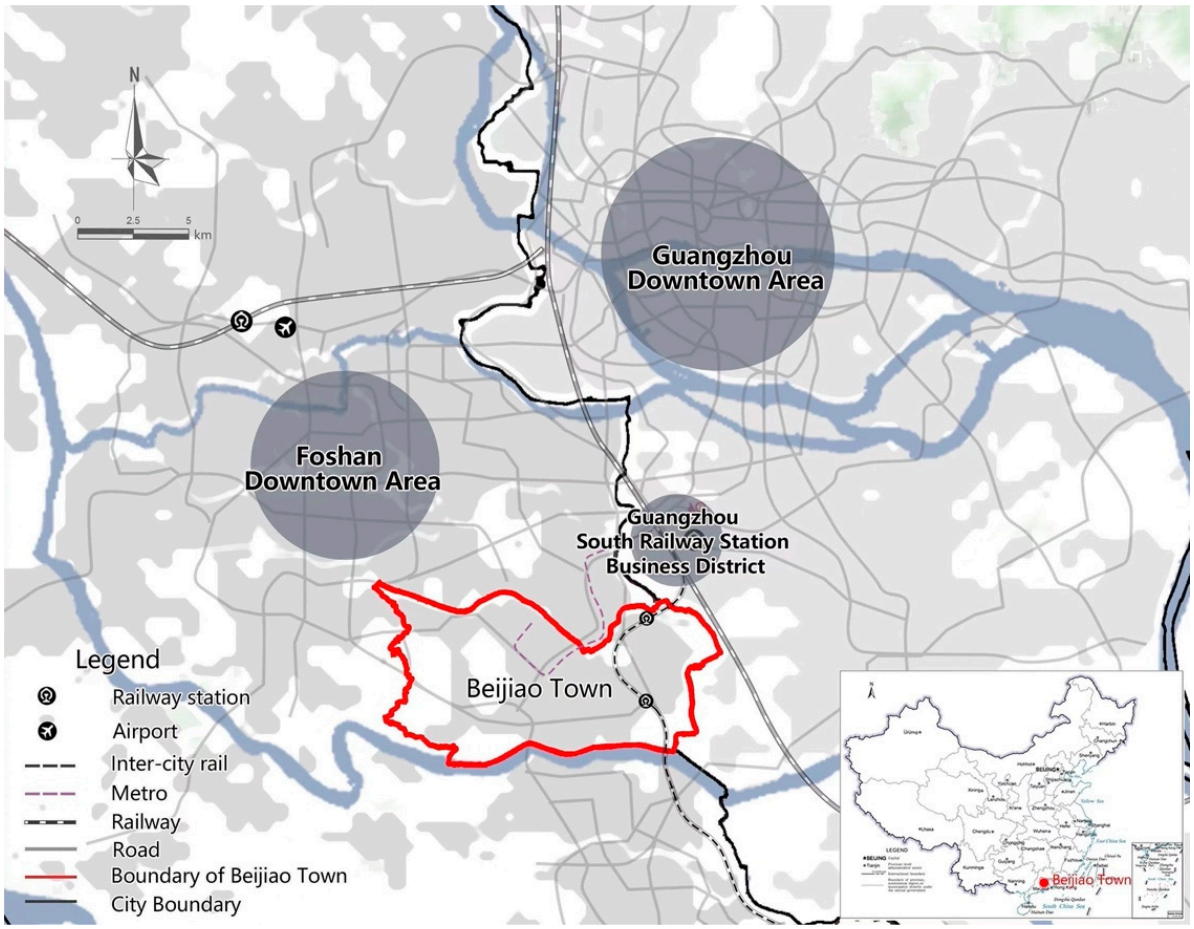

Figure 3. The case study area. The area outlined in red is the project area, called Beijiao Town. The dark circles indicate the main functional urban areas close to the case study area. The transport infrastructure including the railway stations, airports, inter-city railway, metro, railway, and road network, is outlined. The base map was sourced from the Ministry of Natural Resources of China. The figure was generated using Adobe Photoshop™.

2.3. Data Collection and Processing

During this study, we collected three datasets (see Table 1 for more details). Firstly, we collected the firm-level statistics data provided by the Shunde government. The firm-level statistics were further processed to derive other attributes, such as the revenue per square meter and the geographical distribution of the existing clusters. Secondly, we randomly sampled and interviewed a total of 45 firms from the Type-A, Type-B, and Type-C categories. We collected a series of attributes during these interviews and summarized them to constitute the firm-level survey dataset. Supplementary Materials S1 lists the questionnaire we used. Afterward, we used the surveyed attributes to classify more than 2051 firms into Type-A, Type-B, and Type-C classes. Moreover, we also grouped pairs of firms based on the probability of co-location in the same vertical factory. Such an attribute is useful for the government to understand how many vertical factories are needed and communicate with different stakeholders, such as firm owners and village-level governments. Lastly, we collected datasets on the land uses from the Planning Bureau of Shunde.

Table 1. The collected datasets.

Datasets	Attributes	Derived Attributes	Source
Firm-level statistics	Address	The revenue per square meter. The geographical distribution of the industrial clusters.	Economic Census provided by the Shunde government [49]
	Building area		
	Revenue per year		
	Numbers of employees		
	The industrial sector (GB/T4754-2017) Owner		
Firm-level survey	Supply chain position	Type-A, Type-B, and Type-C classification. The co-location probability of two firms in the same vertical factory.	Survey and interviews (see Supplementary Materials S1)
	Products		
	The status of automation adoption		
	New-tech certificates		
	The R&D investments		
	Whether or not the production process can be performed in vertical factories (the weight of the assembly lines)		
	The floor area needed		
	The relocation cost		
Land uses and infrastructure maps	Land uses	Spatial land use structure of the project area	Beijiao Government (classified information)
	Infrastructure maps		

3. Results

This section will first present an example of the local industrial cluster, demonstrating how a Type-A firm dominates the supply chain. Secondly, we will present a pseudo layout of the industrial parks and the proposed resettlement sites. Lastly, we will present the intermediate restructuring outcomes to-date.

3.1. An Example of the Local Industrial Cluster

During the consultation process, we found two forms of supply chain collaborations in the study area. Firstly, vertical collaboration occurred between different firms in the same supply chain. Secondly, horizontal collaboration occurred between firms in the same industry when demands overflowed. The geographically concentrated industrial cluster allows firm owners to promptly make oral contracts with other firms (sometimes their competitors) when they cannot deliver the products with the in-house capacity. The oral contracts were prompt agreements between two firms, avoiding large amounts of paperwork and facilitating the production process. They are frequently used in delivering small amounts of goods. We presented a supply chain example that showcases these two kinds of collaborations in Figure 4. The example comprises supply chain information of multiple metal additive and plastic parts (MAPP) manufacturers in the study area. Amongst them, MAPP manufacturer X has been a successful parts supplier to a large-size household appliances manufacturer in Beijiao. There are a total of seven other firms that supply different intermediate products or services to the MAPP manufacturers. This collaboration is referred to vertical collaboration. Meanwhile, manufacturer X also subcontracted to manufacturer Y and Z during the peak seasons, which is referred to as horizontal collaboration.

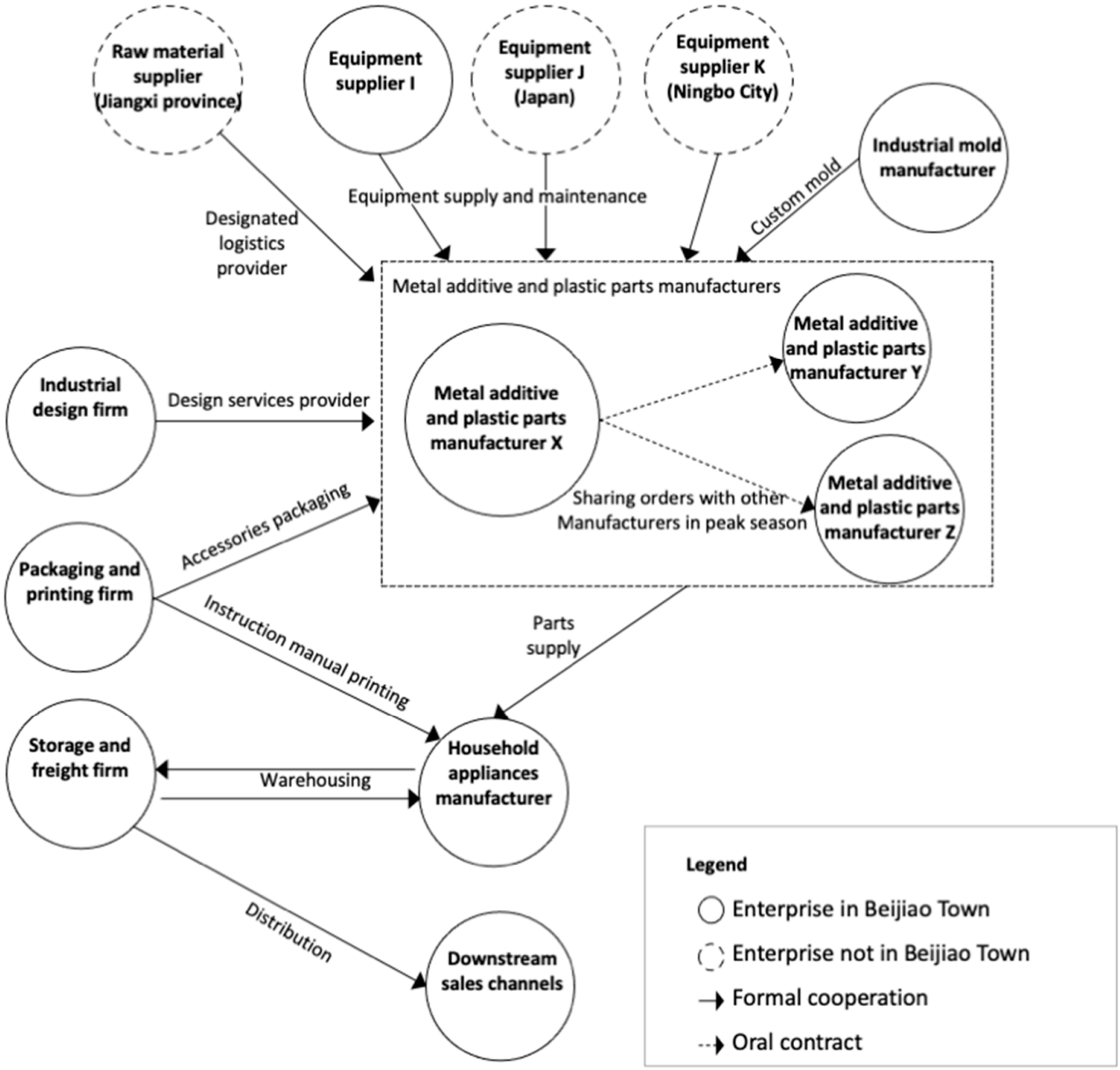

Figure 4. An example of the metal additive and plastic parts supply chain. Such an example is derived from the interviews with the local firms in the case study area.

The example supply chain involves a few suppliers that are located in other cities, provinces and even countries, e.g., the raw material supplier comes from Jiangxi Province and the equipment supplier J comes from Japan. Moreover, the suppliers also belong to different industries, e.g., the industrial design firm and the packaging and printing firm. Moreover, we found that manufacturer X is a key supplier to the household appliances manufacturer, as there is no substitute manufacturer for delivering the parts needed (manufacturer Y and Z cannot meet the household appliances manufacturer's standards). Therefore, manufacturer X was classified as a Type-A firm, while manufacturer Y and Z were classified as Type-C firms. Similar classification practices were performed in another supply chain.

3.2. The Resettlement Sites during Construction

We proposed a series of policies to retain the Type-A and Type-B firms. Besides relocation allowances, the government also provided a series of resettlement sites for the firms to relocate before the construction started. The locations of the resettlement sites were chosen based on three criteria. Firstly, the resettlement sites should be close enough to the original sites, so the relocation cost is affordable. Secondly, the land of the resettlement sites is for industrial use rather than agricultural use. Lastly, the resettlement sites have good access to transport infrastructure.

A pseudo spatial layout is illustrated in Figure 5. The left panel shows the layout of the existing industrial parks, while the right panel shows the proposed resettlement sites. We also defined a series of planning units covering a few villages and industrial parks. The planning units allow the pooling of social capital (e.g., the personnel for monitoring the restructuring process) and infrastructure resources across different villages and sharing the resettlement sites. The planning units also provide a platform for sharing information about contacts and investment interests.

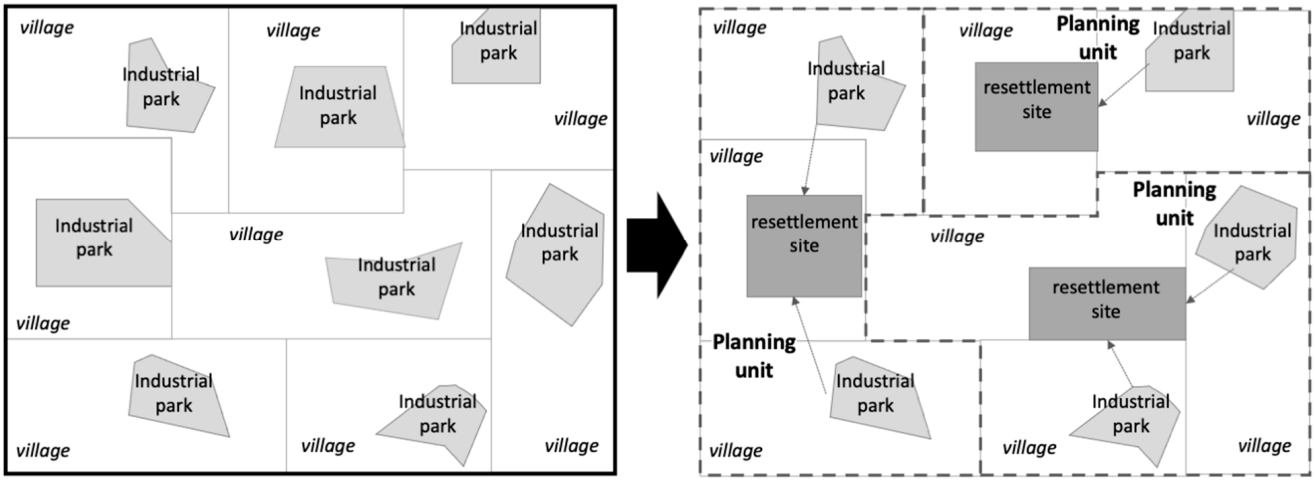

Figure 5. A pseudo spatial layout illustrating the industrial parks and the proposed resettlement sites. The left panel shows the existing spatial structure of the existing industrial parks, which are highlighted in light grey. The administrative boundaries of different villages are also outlined in grey lines. The right panel shows a proposed layout of the resettlement sites, highlighted in dark grey. The boundaries of the planning units are outlined in dotted lines.

3.3. The Intermediate Restructuring Outcomes

3.3.1. The Vertical Factories

One of the novel concepts that is introduced in this study is the use of vertical factories. The main advantage of vertical factories in this case study is the highly efficient land utilization. The vertical factories in this case study considered the relationship between different functional spaces and accommodated the office space and the production lines in one single building. The buildings have special layouts and equipment, such as rampways for moving vehicles between floors and oversized elevators. However, few studies have quantitatively estimated whether or not the production process is more efficient. Some scholars argued that with careful layout planning of the vertical factories, the production process could be as much, if not more efficient, than the conventional single-floor factory [22]. Figure 6, shows an industrial park called Xihai Industrial Park before and after the construction. The first photo was taken in May 2020 and the second photo was taken in August 2022. Vertical factories have improved the urban environment to a great extent.

Figure 6. The industrial park before and after the restructuring. The pictures in panel (**a**) and panel (**c**) shows the same site before and after the restructuring. The location of the restructured industrial site is shown in panel (**b**). The pictures in panel (**a**) and panel (**c**) were kindly provided by the Beijiao government.

3.3.2. The Retained Firms and New Firms

We kept track of the move-in and move-out firms before and during the restructuring process. Before the restructuring was announced in 2019, there were a total of 26 industrial parks in Beijiao and 2051 different-sized firms. Amongst them, there were 316 Type-A firms, 22 Type-B firms and 1713 Type-C firms. By August 2022, a total of five industrial parks have been restructured, and another two parks had come to an agreement with the stakeholders for starting the restructuring process. There are 1469 firms remaining to date, accounting for a 71.6% retaining rate. Amongst the remaining firms, there are 269 Type-A firms, accounting for an 85.1% retention rate for the Type-A firms, and 20 Type-B firms, accounting for a 90.9% retention rate for the Type-B firms. There are 1180 Type-C firms,

which account for a 68.9% retention rate for the Type-C firms. As a whole, a total of 582 firms had been displaced. Due to privacy concerns, this study cannot present the revenue and the number of employees for each firm category. However, as references, we randomly selected an example per category to present their annual revenue and the range of the number of employees in 2018 (see Table 2). We also attach other statistics for different types of firms in Supplementary Materials S2. In the restructuring process, there are still great firms that have left Beijiao Town. In total, 47 Type-A firms have left Beijiao. Among them, 26 firms had terminated their registrations and another 15 firms moved to other towns in Shunde District. One Type-A firm relocated to Guangzhou City, China. There were two Type-B firms that left Beijiao, and they moved to Chencun Town and Xingtan Town, both in Shunde District.

Table 2. The revenue and the number of employees of sampled firms for each category.

Firm Category	Annual Revenue (in CNY)	The Number of Employees (a Range)	The Industry Sector
A sample of Type-A firms	33,550,000	30–40	Metal additive supplier
A sample of Type-B firms	15,671,000	20–30	Plastic additive supplier
A sample of Type-C firms	273,800	1–5	Household appliances

Besides retaining firms, the government also attracted a few industrial projects to the restructured parks with some incentives, such as rent reduction (up to CNY 30 per square meter per month) and allowances for buying new factories (up to CNY 60 per square meter per month). The new firms include Han's Robot Co., whose robots are distributed across more than 100 countries. These new firms enhanced the high-tech industrial cluster in the case study area.

In summary, most Type-A and Type-B firms remained. We believed the resilient industrial cluster and the allowances for retention had encouraged the firms to stay. However, the COVID-19 pandemic slowed the reconstruction process, which concerned other firm owners.

3.3.3. Summary of the Intermediate Outcomes

The restructuring project was announced in 2019, just before the COVID-19 outbreak. Even though the project has been impacted significantly over the last three years, it has achieved tremendous outcomes. We summarized all the major intermediate outcomes in Table 3. The government sets three goals and should also represent the objectives of other restructuring projects elsewhere. The first goal is to improve the land utilization efficiency and provide additional land supply. Two main policies or actions were deployed, including providing resettlement sites and introducing vertical factories. To the best of our knowledge, this is the first project introducing vertical factories in outskirt industrial parks' restructuring process. As a result, the GDP per square kilometer in Beijiao Town increased significantly between 2019 and 2022 (see Table 3). The second goal is to secure the existing industrial cluster and attract new firms to enhance its competitive advantage. Firms were classified based on their contributions to the resilience of the local cluster. Firms that did not meet the qualification criteria were displaced, which allowed the government to provide additional land supply. To attract new firms, the Shunde government deployed some incentives (as discussed above). As a result, a world-leading high-tech company agreed to move into the restructured industrial parks. To retain skilled workers, the government also upgraded the public facilities in the restructured parks and increased green space. As a result, the environment of the parks significantly improved after the construction. This study has not quantitively measured how much the environment has improved after the restructuring. However, from Figure 6, we could visually see the improvement of one of

the industrial parks. The restructuring process is still ongoing, so we expect it to achieve more exciting outcomes soon.

Table 3. The goals, the actions, and the intermediate outcomes.

Goals	Policies/Actions	Outcomes
Improve land utilization efficiency and provide land supply	1. Provision of resettlement sites	In Beijiao Town, the GDP per square kilometer grew from CNY 18.4 billion in 2019 to CNY 24.2 billion in 2022. Additional 9.73 million square meters of vacant land. Additional 49 industrial land parcels.
	2. Vertical factories	
Securing and upgrading the existing industrial clusters	3. Firms classification	269 Type-A firms had been retained. 533 Type-C firms were displaced. One world-leading high-tech firm was added.
	4. Displacement of Type-C firms	
	5. Introducing new firms.	
Improve facilities to retain skilled workers	6. Improve public facilities.	Three community service centers, one kindergarten, and one elderly care service station are under construction.
	7. Increase green space	

4. Discussion

Unlike the previous restructuring attempts, the proposed framework was formulated based on a series of consultations with various stakeholders. The thorough consultation process allows seamless communication with stakeholders, understanding their needs and ultimately facilitating the restructuring process. However, there is still room to improve the consultation process. For example, scholars proposed a place-makring framework where the consultation with stakeholders were organized in a sytemetic way [50].

Through the case study, we validated the proposed framework against three predetermined objectives of the restructuring process (see Figure 1a). Firstly, the land resources in the urban outskirts were utilized more efficiently. That includes two aspects, i.e., more vacant land and higher per square kilometres GDP. Secondly, the environment of the industrial zones had improved (see Figure 6). Lastly, the uses of the land were controlled under unified planning, putting an end to the long-existing fragmented land uses. The case study provides a best practice for other restructuring projects. On the one hand, it proves that the industrial clusters can be sustained after the intensive restructuring process. On the other hand, upgrading the environment could attract high-end firms and, ultimately, other economic activities, e.g., shopping centres, allowing for a more sustainable economic ecosystem.

Even though encouraging outcomes emerged after applying the proposed restructuring framework to those five industrial parks, we observed three main limitations of this study. Firstly, while good-quality firms were retained and new firms were added to the restructured parks, a longitudinal study on their performance has not yet been carried out. Moreover, whether or not these elite firms could positively impact the existing industrial cluster is unknown. For example, if an elite firm could source parts from suppliers who just moved in after the restructuring process, the economy of scale of the supply chain would be enhanced. On the other hand, the displacement of some Type-C firms might cause negative impacts on the industrial clusters, as these firms might provide additional production capacity for elite firms during the peak season. Therefore, the effects of the firm movements on the existing industrial clusters should be studied.

Secondly, the three factors that this study uses to classify firms might have limitations. With the growing geopolitical tensions between economies, some supply chains might expect tremendous emerging challenges, e.g., relocating oversees. In a future study, the geopolitical risks should be taken into account in the restructuring process, constituting the fourth factor.

Thirdly, the framework has not been tested in other case studies in other regions. Therefore, further investigation needs further investigation into whether or not such a framework is practical in different contexts. More specifically, two future studies should be carried out in areas where dominant industries differ from the industries in this case study.

Fourthly, how vertical factories affect the industrial clusters was not studied. To the best our knowledge, few empirical studies specifically analyze how manufacturing benefits from densely concentrated production processes. Therefore, future studies should examine how different industries adapt to such a vertical structure and estimate the change in land utilization efficiency.

Lastly, the restructuring process will certainly have an impact on the region from two different aspects. The surrounding land uses could change significantly. For example, new shopping and entertainment amenities could appear to satisfy the emerging demands. The regional socio-economics status would change as well, e.g., more high-tech workers and higher income. Therefore, future studies should examine how these two aspects change as the result of the restructuring.

5. Conclusions

In this study, we proposed a restructuring framework specific to the urban outskirts and industrial areas and tested it in a real case study. The novelty of our work comprises three aspects. Firstly, we proposed that securing the existing industrial clusters should be given priority. Based on that idea, we proposed a firm classification system that identifies three different kinds of firms based on their contributions to the resilience of the existing industrial cluster. Such a classification guided the restructuring process in the case study, retaining elite firms and displacing relatively inferior firms.

Secondly, the vertical factory concept was introduced in the restructuring framework. To the best of our knowledge, this is the first project introducing vertical factories in the restructuring process of outskirt industrial areas. The vertical factories increased the land utilization efficiency and improved the environment to a great extent (see Figure 6).

Finally, unlike other restructuring projects, the proposed framework encourages firms to be relocated to the allocated resettlement sites before the demolition and construction start. Such a process required more time and effort than other restructuring practices. However, as proved in the case study, all the efforts paid off. As a result, more vacant land is available in the case study area, while the existing industrial clusters are retained.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/land11112004/s1, S1: detailed questionnaire; S2: the statistics of retained, move-in and move-out firms.

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References

1. Burggräf, P.; Dannapfel, M.; Uelpenich, J.; Kasalo, M. Urban Factories: Industry Insights and Empirical Evidence within Manufacturing Companies in German-Speaking Countries. *Procedia Manuf.* **2019**, *28*, 83–89. [CrossRef]
2. Henriques, S.T.; Kander, A. The Modest Environmental Relief Resulting from the Transition to a Service Economy. *Ecol. Econ.* **2010**, *70*, 271–282. [CrossRef]
3. Park, D.; Shin, K. The Service Sector in Asia: Is It an Engine of Growth? *Asian Dev. Bank Econ. Work. Pap. Ser.* **2012**. [CrossRef]
4. An, Y.; Zhou, D.; Yu, J.; Shi, X.; Wang, Q. Carbon Emission Reduction Characteristics for China's Manufacturing Firms: Implications for Formulating Carbon Policies. *J. Environ. Manag.* **2021**, *284*, 112055. [CrossRef] [PubMed]
5. Levinson, A. Technology, International Trade, and Pollution from US Manufacturing. *Am. Econ. Rev.* **2009**, *99*, 2177–2192. [CrossRef]
6. Mano, Y.; Otsuka, K. Agglomeration Economies and Geographical Concentration of Industries: A Case Study of Manufacturing Sectors in Postwar Japan. *J. Jpn. Int. Econ.* **2000**, *14*, 189–203. [CrossRef]
7. Woltjer, J. A Global Review on Peri-Urban Development and Planning. *J. Perenc. Wil. dan Kota* **2014**, *25*, 1–16. [CrossRef]
8. Xu, X.; Zhou, C. On the Formation of the Pearl River Delta Metropolitan Area. *Urban Probl.* **1994**, *3*, 3–6. [CrossRef]
9. Li, X.; Hui, E.C.M.; Chen, T.; Lang, W.; Guo, Y. From Habitat III to the New Urbanization Agenda in China: Seeing through the Practices of the "Three Old Renewals" in Guangzhou. *Land Use Policy* **2019**, *81*, 513–522. [CrossRef]
10. Hauser, C.; Tappeiner, G.; Walde, J. The Learning Region: The Impact of Social Capital and Weak Ties on Innovation. *Reg. Stud.* **2007**, *41*, 75–88. [CrossRef]
11. Zhuo, S.; Wang, X.; Wang, H.; Wang, W.; Huang, J.; She, S. Development Status of Invisible Champion Enterprises in Prefecture-Level Cities: Take Foshan City for Example. *Fortune Today* **2021**, *1*, 19–28. [CrossRef]
12. Allen, A. Environmental Planning and Management of the Peri-Urban Interface: Perspectives on an Emerging Field. *Environ. Urban.* **2003**, *15*, 135–148. [CrossRef]
13. Wei, L.; Meng, Q.; Deng, H. Renewal Model in Semi-Urbanization Area Base the Stock Cooperative System of Rural Land: A Foshan Case. *Planners* **2017**, *33*, 46–53. [CrossRef]
14. Halleux, J.-M.; Marcinczak, S.; van der Krabben, E. The Adaptive Efficiency of Land Use Planning Measured by the Control of Urban Sprawl. The Cases of the Netherlands, Belgium and Poland. *Land Use Policy* **2012**, *29*, 887–898. [CrossRef]
15. Nechyba, T.J.; Walsh, R.P. Urban Sprawl. *J. Econ. Perspect.* **2004**, *18*, 177–200. [CrossRef]
16. Lee, S.; Webster, C. Enclosure of the Urban Commons. *GeoJournal* **2006**, *66*, 27–42. [CrossRef]
17. Lin, T.C. Land Assembly in a Fragmented Land Market through Land Readjustment. *Land Use Policy* **2005**, *22*, 95–102. [CrossRef]
18. Yuan, Q.; Yang, L.; Qiu, J.; Wei, L.; Wang, H. Collectively-Owned Land and Urban-Rural Integration: Foshan's Nanhai District. *Planners* **2009**, *25*, 5–13. [CrossRef]
19. Gomes, E.; Banos, A.; Abrantes, P.; Rocha, J.; Schläpfer, M. Future Land Use Changes in a Peri-Urban Context: Local Stakeholder Views. *Sci. Total Environ.* **2020**, *718*, 137381. [CrossRef]
20. Liang, X.; Li, H.; Zhu, M.; Feng, P.; He, J. Promoting High Quality Development by Upgrading Village Level Industrial Park: A Planning Case in Shunde District, Foshan City. *Planners* **2021**, *4*, 51–56. [CrossRef]
21. Cai, L.; He, J.; Liang, X.; Zhong, N. Full Cycle Monitoring of Low Efficiency Industrial Park Renovation: Shunde Practice. *Planners* **2021**, *6*, 45–49. [CrossRef]
22. Herrmann, C.; Juraschek, M.; Burggräf, P.; Kara, S. Urban Production: State of the Art and Future Trends for Urban Factories. *CIRP Ann.* **2020**, *69*, 764–787. [CrossRef]
23. Liang, Y.; Sun, Y.; Jiang, W. "Marketing Inducement" and "Government Failure": Dilemma and Planning of Industrial Land Renewal—Take Suzhou Industrial Park as an Example. *City Plan. Rev.* **2018**, *6*, 94–102. [CrossRef]
24. Zhu, J.; Ruth, M. Relocation or Reallocation: Impacts of Differentiated Energy Saving Regulation on Manufacturing Industries in China. *Ecol. Econ.* **2015**, *110*, 119–133. [CrossRef]
25. Curran, W. "From the Frying Pan to the Oven": Gentrification and the Experience of Industrial Displacement in Williamsburg, Brooklyn. *Urban Stud.* **2007**, *44*, 1427–1440. [CrossRef]
26. Yang, J.; Chen, Y. Review on the Development of Urban Regeneration in China from 1949 to 2019. *City Plan. Rev.* **2020**, *44*, 9–19.
27. Hackworth, J. Demolition as Urban Policy in the American Rust Belt. *Environ. Plan. A Econ. Space* **2016**, *48*, 2201–2222. [CrossRef]
28. Porter, M.E. *Competitive Advantage of Nations: Creating and Sustaining Superior Performance*; Simon and Schuster: New York, NY, USA, 2011; ISBN 145165149X.
29. Meyer, K.E. International Business in an Era of Anti-Globalization. *Multinatl. Bus. Rev.* **2017**, *25*, 78–90. [CrossRef]
30. Cowen, D. A Geography of Logistics: Market Authority and the Security of Supply Chains. *Ann. Assoc. Am. Geogr.* **2010**, *100*, 600–620. [CrossRef]
31. Boschma, R. Towards an Evolutionary Perspective on Regional Resilience. *Reg. Stud.* **2015**, *49*, 733–751. [CrossRef]

32. Martin, R.; Sunley, P. On the Notion of Regional Economic Resilience: Conceptualization and Explanation. *J. Econ. Geogr.* **2015**, *15*, 1–42. [CrossRef]
33. Frenken, K.; Van Oort, F.; Verburg, T. Related Variety, Unrelated Variety and Regional Economic Growth. *Reg. Stud.* **2007**, *41*, 685–697. [CrossRef]
34. Jacobs, J. *The Economy of Cities*; Vintage: New York, NY, USA, 2016; ISBN 0525432868.
35. Beaudry, C.; Schiffauerova, A. Who's Right, Marshall or Jacobs? The Localization versus Urbanization Debate. *Res. Policy* **2009**, *38*, 318–337. [CrossRef]
36. Boschma, R.; Minondo, A.; Navarro, M. Related Variety and Regional Growth in Spain. *Pap. Reg. Sci.* **2012**, *91*, 241–256. [CrossRef]
37. Liu, D. Analysis of Power Relations between Enterprises and Their Suppliers in Industrial Chain. *Jiangsu Soc. Sci.* **2001**, *3*, 10–13.
38. Cao, D.; He, Z.; Zhang, J.; Luo, J.; Liu, D. Research on the Resilience and Vulnerability of the Whole Industry China of Rail Transit Industry. *J. Quant. Econ.* **2020**, *37*, 16–26.
39. Du, Z.; Jin, L.; Liu, Q. Industrial Diversity, Innovation, and Economic Resilience: Empirical Analysis of the Pearl River Delta in the Post-Financial Crisis Era. *Trop. Geogr.* **2019**, *39*, 170–179. [CrossRef]
40. Li, S.; Song, Y.; Qin, X.; Xu, W.; Li, X. Study on the Industrial Evolution Pattern and Mechanism of the Pearl River Delta under the Background of Financial Crisis: Based on the Perspective of Industry Space Network. *Prog. Geogr.* **2021**, *40*, 635–646. [CrossRef]
41. Hu, G. *Research on Stability of Industrial Chain*; Southwestern University of Finance and Economics: Chengdu, China, 2009.
42. Wu, J.; Zhang, Q.; Zhao, Z. Production Industry Chain, Production Matching Radius and Self-Development Capability of an Enterprise. China Industrial Economy. *China Ind. Econ.* **2005**, *2*, 44–50. [CrossRef]
43. Zheng, L.; Warner, M. Business Incentive Use Among U.S. Local Governments: A Story of Accountability and Policy Learning. *Econ. Dev. Q.* **2010**, *24*, 325–336. [CrossRef]
44. Hidalgo, C.A.; Winger, B.; Barabási, A.L.; Hausmann, R. The Product Space Conditions the Development of Nations. *Science* **2007**, *317*, 482–487. [CrossRef] [PubMed]
45. Li, S.; Li, X.; Chen, H.; Lang, W. China's Export Evolution in the Dynamic Global Product Space from 2000 to 2011. *Curr. Sci.* **2019**, *117*, 470–479. [CrossRef]
46. Sit, V.F.S. Mega-city, extended metropolitan region, desakota, and exo-urbanization: An introduction. *Asian Geogr.* **1996**, *15*, 1–14. [CrossRef]
47. Ginsburg, N.S.; Koppel, B.; McGee, T.G.; Extraordinary Women Engineers Project (EWEP). *The Extended Metropolis: Settlement Transition Is Asia*; University of Hawaii Press: Honolulu, HI, USA, 1991; ISBN 9780824812973.
48. Mcgee, T. *The Spatiality of Urbanization: The Policy Challenges of Mega-Urban and Desakota Regions of Southeast Asia*; United Nations University Press: Tokyo, Japan, 2009.
49. Foshan Municipal Bureau of Statistics. The Fourth National Economic Census of Foshan. 2020. Available online: http://www.foshan.gov.cn/fstjj/gkmlpt/content/3/3892/post_3892355.html#1518 (accessed on 25 October 2022).
50. Huang, Y.; Hui, E.C.; Zhou, J.; Lang, W.; Chen, T.; Li, X. Rural revitalization in China: Land-use optimization through the practice of place-making. *Land Use Policy* **2020**, *97*, 104788. [CrossRef]